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EDITORIAL

Commentary: for the children's sake, avoid non-contrast CT

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Abstract

Enough literature now exists such that doing a non-contrast abdominal or chest computed tomography (CT) scan for suspected mass lesions in children borders on malpractice. Although there is great uncertainty regarding estimated radiation doses and long-term cancer risks in childhood, there is no doubt that an entirely unnecessary CT study does more harm than good. When a chest or abdominal mass is suspected in a child, only a post-intravenous contrast enhanced CT examination is needed, and a prior non-enhanced CT run exposes the child to unnecessary radiation.

Keywords: *Computed tomography; oncology; paediatrics; contrast.*

Some years ago we presented a paper at the European Congress of Radiology with the take-home message that non-contrast enhanced computed tomography (CT) scanning of the abdomen was almost always non-contributory in paediatric oncology imaging[1]. It seems the message has still not gotten through to the general radiological community. Ten years later it is common practice, typically in non-paediatric centres, to include a non-contrast CT run when a new abdominal mass is encountered (Fig. 1). Non-contrast CT is very sensitive in the detection of (tumour) calcification. Calcification is usually easy to see after intravenous contrast administration also, however. All the useful diagnostic information regarding tumour margins, size and characteristics are discernible from the post-contrast CT study[2–5]. Suspected mediastinal masses similarly merit only a post-contrast examination as the lack of mediastinal fat in children, similar to their lack of retroperitoneal fat, makes a non-contrast study essentially uninterpretable; here again a non-contrast enhanced examination is unnecessary irradiation and a waste of time (Fig. 2)[1,6]. Intravenous access in children can admittedly be difficult at times. Nobody would want their child to have an unnecessary CT examination with the associated radiation burden, however. Thus, persevering to ensure adequate intravenous access for a contrast-enhanced CT of diagnostic quality will always be worth the effort.

There is a growing wealth of literature on the harmful effects of the radiation doses from CT scanning, particularly in childhood[7–9]. The Image Gently website and campaign is a very laudable North American effort to reduce doses from paediatric CT to as low as is possible[10]. Approximately 70% of all children with cancer now achieve long-term survival and cure and so the ALARA (as low as reasonably achievable) concept is just as applicable in paediatric oncology patients as it is in other paediatric patients[11,12].

There are only a few specific indications for non-contrast CT in childhood, which include acute brain trauma, suspected renal calculus disease, lung high resolution CT (HRCT) for suspected pulmonary interstitial disease, perhaps paranasal sinus imaging and for some skeletal pathologies[13–15]. Other than these indications, just about all other problems can be addressed by a combination of ultrasound and magnetic resonance imaging (MRI) or contrast-enhanced CT, without the need for a non-contrast CT examination in most situations.

CT imaging parameters are continuously evolving. As an example, for our routine abdominal CT studies we

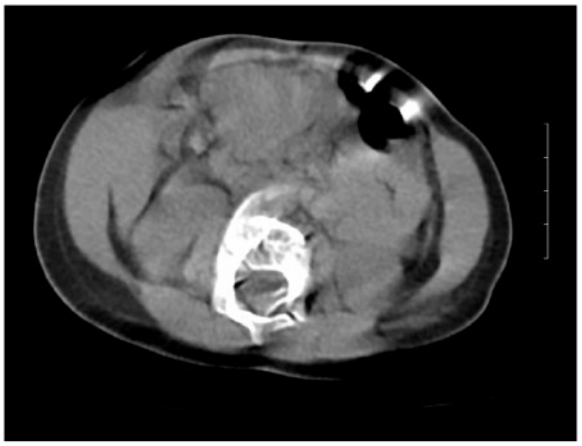

Figure 1 **A 7-month-old baby boy with unexplained irritability and suspected abdominal mass. A non-contrast CT scan was interpreted as normal. The CT images were degraded a little by movement artifact. Without contrast, the abdominal study is really uninterpretable, and unnecessary irradiation. Upon transfer to our hospital 5 h later, an abdominal ultrasound study showed an epigastric intussusception mass. Is the CT examination in this case an example of professional malpractice?**

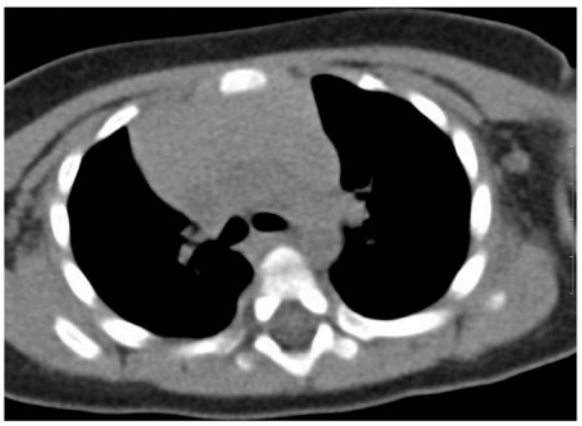

Figure 2 **Chest radiograph showed a possible mediastinal mass in a 2-year-old child who was otherwise well. A non-contrast CT study is uninterpretable as there is no mediastinal fat present, unlike in adult patients, to outline the normal mediastinal structures. A contrast-enhanced study is thus mandatory to define the vascular anatomy in a child, and a non-contrast study is of no benefit. The abnormality on the radiograph was a normal thymus, confirmed with ultrasound. (MRI would have been a better cross-sectional examination than CT in this context).**

currently use 50 mAs for children weighing less than 15 kg, and 75 mAs for children weighing less than 35 kg. With dose modulation, these numbers inevitably vary (and could be regarded as minimum noise reference levels), but they emphasise that when adult parameters

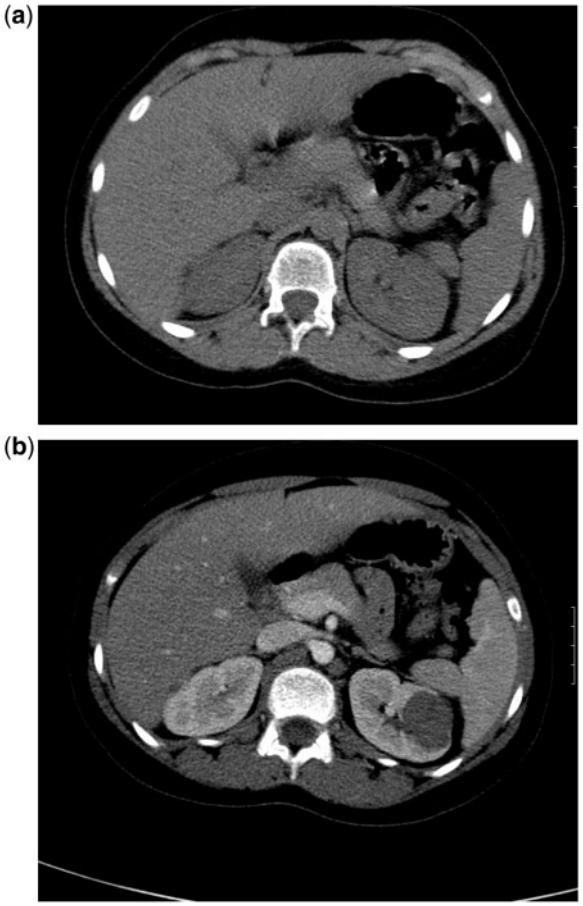

Figure 3 **(a) Non-contrast CT of a suspected mass lesion in the left kidney of an 8-year-old girl, discovered with ultrasound, is essentially normal. (b) Post-intravenous contrast-enhanced CT of the same patient on the same day shows an obvious mass lesion in the left kidney, proven later to be a Wilms tumour (nephroblastoma). The non-contrast study was of no diagnostic benefit here.**

of, say, 200 mAs are used for young patients these doses are unnecessarily high.

Enough literature now exists such that doing a non-contrast abdominal or chest CT for suspected mass lesions in children borders on malpractice[16]. Although there is great uncertainty regarding estimated radiation doses and long-term cancer risks in childhood, there is no doubt that an entirely unnecessary CT study does more harm than good[17]. Please remember, particularly if you do some paediatric imaging, that non-contrast chest or abdominal CT is generally verboten for children.

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